PVP 20

Code: 20EC6601

III B.Tech - II Semester – Regular Examinations – JUNE 2023

INFORMATION THEORY AND CODING

(HONORS in ELECTRONICS & COMMUNICATION ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

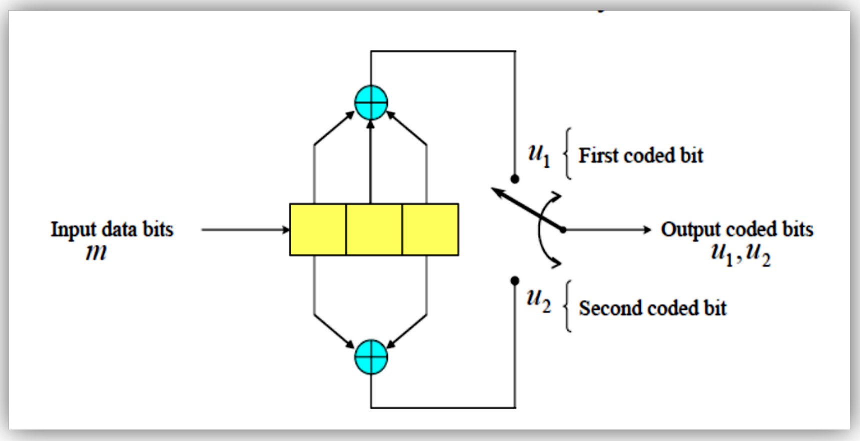
BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	Consider a telegraph source having two symbols, dot and dash. The dot duration is 0.2sec. The dash duration is 3 times the dot duration. The probability of the dot's occurring is twice that of the dash, and the time between symbols is 0.2sec. Calculate the information rate of the telegraph source.	L3	CO1	7 M
	b)	Construct an efficient Huffman code for the following letters with respective occurrence probabilities and hence justify the prefix property of Huffman code.	L3	CO1	7 M

Letter	**Probability**
A	1/2
B	1/4
C	1/8
D	1/16
E	1/16

OR					
2	a)	Consider a binary memory less source X with two symbols x_1 and x_2. Show that H(X) is maximum when both x_1 and x_2 are equiprobable.	L3	CO1	7 M
	b)	A Discrete memoryless source X has five equally likely symbols. (i) Construct a Shannon- Fano code for X and calculate the efficiency of the code. (ii) Construct Huffman code for X and compare the results.	L3	CO1	7 M
UNIT-II					
3	a)	Design a Linear Block Code with a minimum distance of three, and a Code block size of eight bits.	L4	CO2	7 M
	b)	Construct the syndrome evaluation table, with 8 syndrome values and the corresponding error values, for the (7,4) cyclic code with $g(x) = 1+x+x^3$. Find the data word sent if a sequence (1110011) is received.	L4	CO2	7 M
OR					
4	a)	Prove the theorem 'No two n-tuples in the same row of a standard array are identical' by generating the standard array for a (6,3) linear code generated by the following matrix: $$G = \begin{bmatrix} 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$	L3	CO2	7 M

	b)	With a suitable example, explain the error detection capabilities of a Hamming code.	L2	CO2	7 M
UNIT-III					
5	a)	A (7,4) cyclic code has a generator polynomial $g(x) = 1 + x + x^3$. (i) Write the syndrome circuit. (ii) Verify the circuit for the message polynomial $d(x) = 1 + x^3$	L4	CO3	10 M
	b)	Write short notes on shortened cyclic codes.	L2	CO3	4 M
OR					
6	a)	Design an encoder for the (15,11) cyclic Hamming code generated by $g(x) = 1 + x + x^4$	L4	CO3	10 M
	b)	Describe the various steps of error-trapping decoding process through a neat diagram.	L2	CO3	4 M
UNIT-IV					
7	a)	Using the convolutional encoder shown in Figure 1, encode the message sequence (1 0 1) and compute the effective code rate. **Figure 1.**	L4	CO4	10 M



	b)	Explain Sequential decoding for convolutional codes.	L2	CO4	4 M
		OR			
8	a)	Consider the (3,1,2) convolutional code with $g^{(1)} = (1\ \ 1\ \ 0)$ $g^{(2)} = (1\ \ 0\ \ 1)$ $g^{(3)} = (1\ \ 1\ \ 1)$ Draw the state diagram of the encoder.	L2	CO4	10 M
	b)	Explain Trellis diagram technique for convolutional encoder.	L2	CO4	4 M
		UNIT-V			
9	a)	Elucidate on the iterative algorithm for finding the error location polynomial for BCH codes.	L3	CO4	10 M
	b)	Devise a syndrome computation circuit for a binary single-error correcting (15,11) BCH code. Assume appropriate values for the same.	L4	CO4	4 M
		OR			
10	a)	Analyze in detail about BCH Codes.	L4	CO4	10 M
	b)	Prove that the syndrome components S_i and S_{2i} are related by $S_{2i} = S_i^2$	L3	CO4	4 M